

CLAIMS

WE CLAIM:

1. A process comprising:

lithiating a compound of the formula R^1-H , where R^1 represents an aryl group substituted by an alkoxy, aryloxy, dialkylamino, dialkylaminoalkyl, dialkylamido, alkoxyalkoxy, alkylthio, alkylsulfonyl, dialkylamidosulfonyl, alkylsulfonate or lithiated hydroxyl group;

with a compound of the formula $Q-Li$, where Q represents an alkyl, cycloalkyl, aralkyl or aryl group;

in a solvent comprising an ether compound of the formula E^1-O-E^2 , where each of E^1 and E^2 independently represent a substituted alkyl group or a substituted aryl group, and having a boiling point of at least 40°C at atmospheric pressure.
2. The process of claim 1 in which R^1 represents a phenyl group substituted by an alkoxy or aryloxy group.
3. The process of claim 1 in which E^1 represents a C_{1-12} alkyl group or a phenyl group substituted by a polar group at the 2-position and E^2 represents a C_{1-12} alkyl group.
4. The process of claim 1 in which E^1 represents a C_{1-4} alkyl group and E^2 represents a branched C_{3-6} alkyl group.
5. A process for the preparation of a compound of the formula R^1_3P , where R^1 represents an aryl group substituted by an alkoxy, aryloxy, dialkylamino, dialkylaminoalkyl, dialkylamido, alkoxyalkoxy, alkylthio, alkylsulfonyl, dialkylamidosulfonyl, alkylsulfonate or lithiated hydroxyl group, comprising:

lithiating a compound of the formula R^1-H ;

with a compound of the formula $Q-Li$, where Q represents an alkyl, cycloalkyl, aralkyl or aryl group;

in a solvent comprising an ether compound of the formula E^1-O-E^2 , where each of E^1 and E^2 independently represent a substituted alkyl group or a substituted aryl group, and having a boiling point of at least 40°C at atmospheric pressure; and

reacting the resultant compound R^1-Li , without isolation thereof, with phosphorous trichloride.

6. A process for the preparation of a compound of the formula R_2P-Li , comprising reacting a compound of formula R_2P-L with lithium, where R is a substituted hydrocarbyl group, and L represents a leaving group.
7. The process of claim 6, performed at a temperature not exceeding 60°C.
8. The process of claim 6, where L is $-NR''_2$, $-PR''_2$ or $-ZR''$ where Z is O or S and R'' is C_1-C_6 alkyl, or, when L is $-NR''_2$ or $-PR''_2$, the two R'' moieties taken together form an optionally substituted C_4-C_8 alkylene chain.
9. The process of claim 6, where R is hydrocarbyl substituted with a polar moiety.
10. The process of claim 9, where R is aryl substituted with a polar moiety.
11. The process of claim 10, where R is a phenyl group that is ortho-substituted with a single polar moiety.
12. The process of claim 9, where the polar moiety is selected from the group consisting of halogen, haloalkoxy, alkoxy, amino, monoalkylamino, dialkylamino, aminoalkyl, monoalkyl-aminoalkyl, dialkyl-aminoalkyl, amido, monoalkylamido, dialkylamido, alkoxyalkoxy, alkylthio, alkylsulfonyl, dialkylamidossulfonyl, alkylsulfonate, lithio-oxy, aryloxy, sulfonyl, and alkali metal sulfonate.
13. The process of claim 12, where the polar moiety is alkoxy or aryloxy.
14. The process of claim 13, where the polar moiety is methoxy or phenyloxy.
15. A process for the preparation of a compound of the formula R^1_2P-Li , comprising reacting a compound of formula R^1_2P-L with lithium, where R^1 is a substituted hydrocarbyl group, and L represents a group of formula $-NR''_2$ where each group R'' represents an alkyl group or the groups R'' together constitute an alkylene chain.
16. A process for the preparation of a compound of the formula R_2P-Li , comprising:
 - reacting a compound of the formula R^1-Li , where R^1 represents an aryl group substituted by an alkoxy, aryloxy, dialkylamino, dialkylaminoalkyl, dialkylamido, alkoxyalkoxy, alkylthio, alkylsulfonyl, dialkylamidossulfonyl, alkylsulfonate or lithiated hydroxyl group;
 - with a compound of the formula Hal_2P-L , where L represents a leaving group and Hal represents a halogen atom;
 - in a solvent comprising an ether compound of the formula E^1-O-E^2 , where E^1 and

- E^2 independently represent a substituted alkyl group or a substituted aryl group, and having a boiling point of at least 40°C at atmospheric pressure.
17. The process of claim 16 further comprising:
- reacting a compound of the formula R^1-H , where R^1 represents an aryl group substituted by an alkoxy, aryloxy, dialkylamino, dialkylaminoalkyl, dialkylamido, alkoxyalkoxy, alkylthio, alkylsulfonyl, dialkylamidodisulfonyl, alkylsulfonate or lithiated hydroxyl group;
 - with a compound of the formula $Q-Li$, where Q represents an alkyl, cycloalkyl, aralkyl or aryl group;
 - in a solvent comprising an ether compound of the formula E^1-O-E^2 , where each of E^1 and E^2 independently represent a substituted alkyl group or a substituted aryl group, and having a boiling point of at least 40°C at atmospheric pressure;
 - to produce a resulting compound of the formula R^1-Li ; and
 - reacting said resulting compound with a compound of the formula Hal_2P-L , where L represents a group of formula $-NR''_2$ where each group R'' represents an alkyl group or the groups R'' together constitute an alkylene chain and Hal represents a halogen atom;
 - in a solvent comprising an ether compound of the formula E^1-O-E^2 , where E^1 and E^2 independently represent a substituted alkyl group or a substituted aryl group, and having a boiling point of at least 40°C at atmospheric pressure;
 - to produce a resulting compound of the formula R^1_2P-L ; and
 - reacting said resulting compound with lithium.
18. The process of claim 16, where Hal is chloro, bromo or iodo.
19. A process for the preparation of a compound of the formula $R^1_2P-X-PR^1_2$, where R^1 represents an aryl group substituted by an alkoxy, aryloxy, dialkylamino, dialkylaminoalkyl, dialkylamido, alkoxyalkoxy, alkylthio, alkylsulfonyl, dialkylamidodisulfonyl, alkylsulfonate or lithiated hydroxyl group; and X is a bivalent bridging group; comprising:
- reacting a compound of the formula R^1-Li ;
 - with a compound of the formula Hal_2P-L , where L represents a leaving group and Hal represents a halogen atom;

- in a solvent comprising an ether compound of the formula E^1-O-E^2 , where E^1 and E^2 independently represent a substituted alkyl group or a substituted aryl group, and having a boiling point of at least 40°C at atmospheric pressure;
- to produce a resulting compound of the formula R^1_2P-L ; and
- further reacting said resulting compound with a compound of the formula $Hal-X-Hal$ where Hal is a halogen atom, without isolation of the R^1_2P-Li compound.
20. The process of claim 19 further comprising:
- reacting a compound of the formula R^1-H ;
- with a compound of the formula $Q-Li$, where Q represents an alkyl, cycloalkyl, aralkyl or aryl group;
- in a solvent comprising an ether compound of the formula E^1-O-E^2 , where E^1 and E^2 independently represent a substituted alkyl group or a substituted aryl group, and having a boiling point of at least 40°C at atmospheric pressure;
- to produce a resulting compound of the formula R^1_2P-L ; and
- further reacting said resulting compound with a compound of the formula $Hal-X-Hal$ where Hal is a halogen atom, without isolation of the R^1_2P-Li compound.
21. The process of claim 19, where X contains 2 to 4 bridging atoms, at least two of which are carbon atoms.
22. The process of claim 21, where X is C_2-C_4 alkylene substituted with one C_1-C_4 alkyl group.
23. The process of claim 19, where all four R^1 substituents in the compound of the formula $R^1_2P-X-PR^1_2$ are identical.
24. A process for the preparation of a compound of the formula $R_2P^+(L)-X-P^+(L)R_2 2Hal-$, where R is a substituted hydrocarbyl group, X is a bivalent bridging group, Hal is a halogen atom and L is a leaving group, comprising:
- reacting a compound of the formula R_2P-L ;
- with a compound of the formula $Hal-X-Hal$.
25. The process of claim 24, in which the process is carried out in the presence of a polar aprotic solvent at an elevated temperature.
26. A process for the preparation of a compound of the formula $R^1_2P^+(L)-X-P^+(L)R^1_2 2Hal-$,

where R^1 represents an aryl group substituted by an alkoxy, aryloxy, dialkylamino, dialkylaminoalkyl, dialkylamido, alkoxyalkoxy, alkylthio, alkylsulfonyl, dialkylamidofulfonyl, alkylsulfonate or lithiated hydroxyl group; X represents a bivalent bridging group; L represents a group of formula $-NR''_2$ where each group R'' represents an alkyl group or the groups R'' together constitute an alkylene chain; and Hal represents a halogen, comprising:

reacting a compound of the formula R^1-Li ;

with a compound of the formula Hal_2P-L ;

in a solvent comprising an ether compound of the formula E^1-O-E^2 , where E^1 and E^2 independently represent a substituted alkyl group or a substituted aryl group, and having a boiling point of at least 40°C at atmospheric pressure.

27. A process for the preparation of a compound of the formula $R^1_2P^+(L)-X-P^+(L)R^1_2Hal-$, where R^1 represents an aryl group substituted by an alkoxy, aryloxy, dialkylamino, dialkylaminoalkyl, dialkylamido, alkoxyalkoxy, alkylthio, alkylsulfonyl, dialkylamidofulfonyl, alkylsulfonate or lithiated hydroxyl group; X represents a bivalent bridging group; Hal is a halogen atom; and L is a leaving group, comprising:

reacting a compound of the formula R^1-H ;

with a compound of the formula $Q-Li$, where Q represents an alkyl, cycloalkyl, aralkyl or aryl group;

in a solvent comprising an ether compound of the formula E^1-O-E^2 , where each of E^1 and E^2 independently represent a substituted alkyl group or a substituted aryl group, and having a boiling point of at least 40°C at atmospheric pressure;

to produce a resulting compound of the formula R^1-Li ; and

further reacting said resulting compound with a compound of the formula Hal_2P-L .

28. A process for the preparation of a compound of the formula $R^1_2P-X-PR^1_2$, where R^1 represents an aryl group substituted by an alkoxy, aryloxy, dialkylamino, dialkylaminoalkyl, dialkylamido, alkoxyalkoxy, alkylthio, alkylsulfonyl, dialkylamidofulfonyl, alkylsulfonate or lithiated hydroxyl group; and X represents a bivalent bridging group, comprising:

reacting a compound of the formula R^1-Li ;

with a compound of the formula Hal_2P-L , where L represents a group of formula $-NR''_2$ where each group R'' represents an alkyl group or the groups R'' together constitute an alkylene chain; and Hal represents a halogen atom;

in a solvent comprising an ether compound of the formula E^1-O-E^2 , where E^1 and E^2 independently represent a substituted alkyl group or a substituted aryl group, and having a boiling point of at least 40°C at atmospheric pressure; and

further reacting with a compound of the formula $Hal-X-Hal$.

29. A process for the preparation of a compound of the formula $R^1_2P-X-PR^1_2$, where R^1 represents an aryl group substituted by an alkoxy, aryloxy, dialkylamino, dialkylaminoalkyl, dialkylamido, alkoxyalkoxy, alkylthio, alkylsulfonyl, dialkylamidofulfonyl, alkylsulfonate or lithiated hydroxyl group; and X represents a bivalent bridging group, comprising:

reacting a compound of the formula R^1-H ;

with a compound of the formula Hal_2P-L , where L represents a group of formula $-NR''_2$ where each group R'' represents an alkyl group or the groups R'' together constitute an alkylene chain; and Hal represents a halogen atom;

in a solvent comprising an ether compound of the formula E^1-O-E^2 , where E^1 and E^2 independently represent a substituted alkyl group or a substituted aryl group, and having a boiling point of at least 40°C at atmospheric pressure; and

further reacting with a compound of the formula $Hal-X-Hal$.